QUARTERLY REPORT
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1. Remote sensing of aerosol from space

1.1 The MODIS aerosol and atmospheric correction topical meeting Preparations are being made to the MODIS aerosol and atmospheric correction workshop. We anticipate about 40 participants, from the aerosol community including EOS, NOAA and NASA as well as scientists from Japan and France. In the meeting, the procedures for remote sensing of aerosol from MODIS will be reviewed and exposed to criticism or cheering from the scientific community. We shall use the opportunity to generate a better interaction between the ocean, land / atmosphere groups in MODIS regarding aerosol and between MODIS and MISR. This will be a good preparation for the algorithm development during the rest of the year.

1.2 Surface reflectance spectra
As part of the effort to generate a library of surface reflectance spectra that can be used to develop and test methods for remote sensing of aerosol and for atmospheric corrections, the following action were taken:

- Additional improvements in the paper on the relation between the surface reflectance at 0.64 and 3.75 μm channels for remote sensing of aerosol.
- Preparation of data sets from quantified photography above a desert transition zone. The data set includes 4 channels in the blue, green, red and near IR of the spectrum. It includes varying densities of vegetation cover. Severe problems were encountered regarding the calibration of the data. These problems are being addressed.
- AVIRIS and TM data sets are being assembled for the generation of a library in the MODIS bands in the range 0.41-2.15 μm. The effort is large for our present capability. We anticipate to hire in June an additional person for a year in order to enhance the data preparation. Collaboration with Dr. Verstrate are expected to help in generalizing the data set in order to represent also the angular properties of the surface.

1.3 Ground based remote measurements of aerosol The analysis of ground based measurements of the spectral optical thickness and the sky radiance are continued. A first draft of the paper was produced. The main question that we try to address is if the radiative transfer models that assume spherical homogeneous particles are being able to compute the correct scattering phase function. Comparison was made between aerosol scattering phase functions derived from the measurements in 3 different ways:

- From the spectral optical thickness a power law size distribution was derived and used to compute the scattering phase function.

- From the aureole sky radiance for scattering angles of 0 to 40^{o}, the size distribution was retrieved and used to compute the scattering phase function.

- From the sky radiance measured in the antisolar directions, the phase function was derived directly, by correction for multiple scattering and molecular scattering. A comparison between the three phase functions, showed that they differed within 0-30%. Part of this variation may be attributed to experimental errors (mainly uncertainty in the surface reflectance) and part to the uncertainties in the size distribution and/or the particle properties.

1.4. Stratospheric aerosol from the 1.375 μm channel. Based on R.S. Fraser's suggestion, the 1.375 μm channel may be useful for remote sensing of stratospheric aerosols. This channel was introduced to MODIS for remote sensing of cirrus clouds, since the surface and atmosphere under 6 km of altitude is dark due to the strong water vapor absorption. Stratospheric aerosols also will brighten this channel. Although stratospheric aerosols can be sensed from the SAGE instrument in several spectral bands, and as a function of altitude, the MODIS 1.375 μm channel will be able to sense the integrated amount of aerosol in this single channel but on a daily basis and with a high spatial resolution. Preliminary computation show that the channel should be useful for remote sensing of stratospheric aerosols when aerosol concentrations are moderate to large and when the atmosphere is otherwise clear. We anticipate to distinguish between cirrus clouds and stratospheric aerosol based on the difference in the spatial variability between the two substances. A paper on remote sensing of cirrus clouds and stratospheric aerosols was presented by Bo-Cai Gao in the SPIE conference in Florida.

2. SCAR (Smoke Cloud And Radiation) experiment

The field experiment was discussed in the MODIS meeting with participation of the NASA/HQR administrators. The preparations for the July 1993 experiment from NASA/Wallops are being conducted. In addition to the ER-2 with the MODIS simulator and the AVIRIS instrument, the experiment will include the instrumented aircraft from the University of Washington. Ground based remote sensing is also planed. As a result the physical and chemical properties of aerosol, the distribution of water vapor, the properties of clouds and the radiation field will be measured using several platforms: - Satellite measurements and retrieval of aerosol, water vapor and cloud properties, as well as surface reflectance. - Aircraft measurements of radiation in 0.4-14 μm range and retrieval of aerosol, water vapor, cloud properties, and surface reflectance. - Aircraft sampling to detect SO2, a precursor for sulfate aerosol, aerosol size distribution, scattering and absorption coefficient, cloud drop size and chemistry, water vapor.

- Ground based measurements of the aerosol optical thickness, size distribution and scattering phase function.

A combination of these measurements will be used to test algorithms for remote sensing from MODIS to study aerosol cloud interaction. A workshop on the experiment is planned for April 26-27. Lorraine Remer with Eric Vermote and Brent Holben are preparing plans for the flight paths of the planes in the experiment.

3. Plans for the second quarter, April-June: - Participation in the International Global Atmospheric Chemistry workshop April 18-22.

- SCAR workshop: April 26-27.
- Organization of the topical meeting on remote sensing of aerosol from MODIS and other EOS sensors May 17-18.
- Participation in the AGU meeting May 22-26. - Preparation for the SCAR experiment (Lorraine Remer) - Development of the theoretical basis for algorithms:
- remote sensing of aerosol (Kaufman, Tanre); - atmospheric corrections (Vermote, Remer, Kaufman and Tanre); - remote sensing of water vapor (Gao, Kaufman). - Visit with D. Tanre in Lille, collaboration on remote sensing of aerosol - June 8-27.
- Chairing the biomass burning project in the workshop on International Global Aerosol Project in Geneva, June 28-July 2. - Preparation of data sets for analysis of the spectral surface properties (GAO).
- Analysis of remote sensing of CO from MAS (GAO). - Analysis of effect of smoke on the upward spectral radiance from AVIRIS image (GAO).
- Finish the paper on almucantar analysis of the aerosol size distribution and scattering phase function, including dust, sulfates biomass burning aerosol and stratospheric aerosol (Kaufman).